Department of Pesticide Regulation

Mary-Ann Warmerdam
Director

Arnold Schwarzenegger
Governor

December 22, 2008

TO: Interested Parties

SUBJECT: ANNUAL REPORT OF VOLATILE ORGANIC COMPOUND EMISSIONS FROM THE SACRAMENTO METRO, SAN JOAQUIN VALLEY, SOUTH COAST, SOUTHEAST DESERT, AND VENTURA OZONE NONATTAINMENT AREAS

Title 3, California Code of Regulations (3 CCR), section 6425.4 requires the Director of the Department of Pesticide Regulation (DPR) to issue an annual report of volatile organic compound (VOC) emissions from pesticides for the Sacramento Metro, San Joaquin Valley, South Coast, Southeast Desert, and Ventura ozone nonattainment areas. As required under 3 CCR section 6452.4, DPR is making this draft report available for public comment. The report includes:

- Pesticide VOC emissions from May 1, 2007, to October 31, 2007, the peak ozone season in California. These calculations are based on data reported to or produced by DPR.
- A comparison of the VOC emissions to the regulatory benchmarks and, if required, proposed fumigant emission limits as specified in 3 CCR section 6452.2.
- Emission ratings (fraction of applied amount that volatilizes) for each fumigant method specified in the regulations.

DPR will accept comments on this draft report until February 11, 2009. Comments should be submitted in writing to:

Rosemary Neal, Ph.D.
Department of Pesticide Regulation
Environmental Monitoring Branch
P.O. Box 4015
Sacramento, California 95812-4015
Fax: 916- 324-4088
Email: <rneal@cdpr.ca.gov>

More information on pesticide VOCs is available from DPR's Web site at: <http://www.cdpr.ca.gov/docs/emon/vocs/vocproj/vocmenu.htm>.

Sincerely,

Original signed by

Randy Segawa
Environmental Program Manager
Environmental Monitoring Branch
916-324-4137

DRAFT 12-19-08

ANNUAL REPORT ON VOLATILE ORGANIC CHEMICAL EMISSIONS FROM PESTICIDES: EMISSIONS FOR 1990 – 2007

Rosemary Neal, Ph.D.
Staff Environmental Scientist

Frank Spurlock, Ph. D
Research Scientist III

and

Randy Segawa
Environmental Program Manager I

December 2008

California Environmental Protection Agency
Department of Pesticide Regulation
Environmental Monitoring Branch
P.O. Box 4015
Sacramento, California 95812-4015
(916) 324-4100

EHXX-XX

EXECUTIVE SUMMARY

Preface

This report fulfills the requirements of Title 3, California Code of Regulations, section 6425.4 which requires the Director of Department of Pesticide Regulation (DPR) to issue an annual emissions inventory report for the Sacramento Metro, San Joaquin Valley, South Coast, Southeast Desert, and Ventura ozone nonattainment areas. This report presents data reported to or produced by DPR from May 1, 2007, to October 31, 2007, the peak ozone season in California. In addition, data from the same months in 1990 and 1991 are included for baseline comparisons, and from 2005 and 2006 for trend analysis.

Background

As required by the federal Clean Air Act, the Department of Pesticide Regulation (DPR) estimates and tracks pesticide volatile organic chemical (VOC) emissions, using pesticide use reports and data on the VOC content of pesticide products. Under the federal Clean Air Act, California must meet national standards for airborne pollutants and must specify how it plans to achieve these goals in a federally approved State Implementation Plan (SIP). Five regions in California – the Sacramento Metro area, the San Joaquin Valley, the Southeast Desert region, Ventura county and the South Coast area - exceed federal ozone standards and are therefore designated nonattainment areas (NAAs). Under the SIP, approved by the U.S. EPA in 1997, DPR must track and control VOC emissions from pesticide products used in agriculture and by commercial structural applicators in these five NAAs. Under the SIP, California is expected to reduce pesticide VOCs by up to 20 percent (depending on the NAA) compared to 1990 levels.

DPR's VOC emission inventory database includes only pesticide applications that are made between May 1 and October 31, the peak ozone season in California. The database is updated when annual pesticide use report data from the previous year becomes available, and contains data for every year since 1990. Each year contains about 2.5 million pesticide use records (PUR) and emission potential (EP) values for approximately 5,000 products. The EP is that fraction of a product that is assumed to contribute to atmospheric VOCs.

In January 2008 DPR adopted regulations to reduce VOC emissions from fumigant pesticides. The regulations include specific emission target levels (VOC regulation benchmarks) equivalent to a 20 percent reduction from 1991 emissions. These regulatory goals were set to meet the terms of a federal court order, not DPR's obligation under the SIP. The regulations reduce VOC emissions by requiring low-emission fumigation methods in certain NAAs. In all NAAs but Ventura, if, in spite of these application method requirements, pesticide VOC emissions exceed 80 percent of the benchmark for a NAA, DPR will, as specified by the regulations, ensure that the benchmark is achieved by establishing a fumigant limit. A fumigant limit is required at least through 2011 in Ventura. The fumigant limit is determined by subtracting the estimated non-fumigant emissions from the regulatory benchmark, basing the non-fumigant emissions estimate on VOC emission inventory data from previous years. The federal court order that had

determined the level of the regulatory benchmarks was overturned in August 2008. DPR has recently noticed amendments to the fumigant regulations to adjust the regulatory benchmarks to be consistent with its SIP obligation.[1] Adoption and approval of these regulations will eliminate the need for the fumigant limits in the San Joaquin Valley and Southeast Desert NAAs referenced in this report.

Report Summary

- Sacramento Metro NAA: VOC emissions increased between 2004 and 2006 but decreased in 2007. Emissions remain well below the SIP goal and the VOC regulation benchmark. In 2007, 82 percent of emissions were derived from non-fumigants.
- San Joaquin Valley NAA: VOC emissions increased in 2005 and 2006 and then decreased to below 2004 levels in 2007. The 2007 emissions are below the SIP goal but exceed the VOC regulation benchmark by 1.279 tpd. Two thirds of emissions are derived from non-fumigants.
- Southeast Desert NAA: VOC emissions decreased annually through 2006, but then increased in 2007. Emissions in this NAA meet the SIP goal but exceed the VOC regulation benchmark. Emissions from fumigants account for approximately two thirds of total.
- Ventura NAA: VOC emissions have decreased, but do not meet the regulation benchmark and SIP goal for 2012, but do meet the regulation benchmark 2009 of 3.63 tpd. More than 85 percent of emissions are derived from fumigants.
- South Coast NAA: VOC emissions decreased and remain well below the emission targets.

VOC emissions in the Sacramento Metro and South Coast NAAs are well below their regulatory benchmarks, therefore fumigant limits are not required in 2009. In 2007, VOC emissions in the San Joaquin Valley, Southeast Desert were over 80 percent of the regulatory benchmark triggering fumigant limits for 2009. Fumigant limits are required by regulation in the Ventura NAA for each year until at least 2011. Overall emissions declined for the Ventura NAA from 2004 to2007, with total emissions below the regulatory benchmark for 2009, but above the regulatory benchmark set for each year through 2011.the total adjusted fumigant emissions for 2007 to below the projected fumigant limit for 2009.

[1] This change would calculate the percentage reduction required by the SIP from a base year of 1990 rather than 1991 as ordered by the federal court. It would also change the target reduction to 12 per cent in the San Joaquin Valley NAA rather than the 20% order by the federal court.

Abbreviations and Definitions

AI Active Ingredient
APCD Air Pollution Control District
AMAF Application Method Adjustment Factor
ARB California Air Resources Board
EP Emission Potential
GIS Geographic Information System
MUF Method Use Fraction
NAA nonattainment area
PUR pesticide use report
SIP state implementation plan
TGA thermogravimetric analysis
tpd tons per day
VOC Volatile Organic Chemical

ACKNOWLEDGEMENTS

The authors wish to thank the reviewers whose unique perspectives and experiences helped ensure the accuracy and readability of this report. We gratefully acknowledge the staff of DPR and cooperating federal, state, local, and private agencies for contributing to the database.

DISCLAIMER

The mention of commercial products, their source, or their use in this report is not to be construed as either an actual or implied endorsement of such product.

TABLE OF CONTENTS

EXECUTIVE SUMMARY
- Preface
- Background
- Report Summary
- Abbreviations and Definitions

ACKNOWLEDGEMENTS
DISCLAIMER
LIST OF TABLES
LIST OF FIGURES
OVERVIEW
- Introduction
- Nonattainment Area Goals
- Procedure For Calculating Unadjusted and Adjusted VOC Emissions
- Revised Emission Potential Values and New Method Use Fractions

VOLATILE ORGANIC COMPOUND INVENTORY RESULTS
- Sacramento Metropolitan Area - NAA 1
- San Joaquin Valley - NAA 2
- Southeast Desert - NAA 3
- Ventura - NAA 4
- South Coast - NAA 5

PROJECTION FOR 2009 VOC EMISSIONS IN THE SAN JOAQUIN VALLEY, SOUTHEAST DESERT AND VENTURA NONATTAINMENT AREAS.
REFERENCES
APPENDIX 1 – SUMMARY OF APPLICATION METHOD ADJUSTMENT FACTORS AND METHOD USE FRACTIONS
APPENDIX 2 – SUMMARY OF UNADJUSTED PESTICIDE VOC EMISSIONS
APPENDIX 3 – SUMMARY OF ADJUSTED PESTICIDE VOC EMISSIONS
APPENDIX 4 - FIELD FUMIGATION METHODS

LIST OF TABLES

Table 1. Key information included in pesticide use reports that form the basis of DPR's VOC emission inventory.
Table 2. A listing of counties wholly or partially within nonattainment areas in California.
Table 3. Nonattainment Area Goals for 2009 – 2012.
Table 4. Method codes and emission ratings for night applications of MITC application methods.
Table 5. Method codes and emission ratings for sprinkler 4am start MITC application method.
Table 6a. May–October (ozone season) *adjusted* pesticide VOC emissions and goals.
Table 6b. May–October (ozone season) fumigant and non-fumigant pesticide VOC emissions.

Table 7. Top ten primary active ingredients contributing to **2007** May-October ozone season *adjusted* VOC emissions in NAA 1, the Sacramento Metropolitan Area.
Table 8. Top ten pesticide application sites contributing to **2007** May-October ozone season *unadjusted* VOC emissions in NAA 1.
Table 9. *Unadjusted* **2007** May–October VOC emissions in NAA1 by ARB emission inventory classification (tons per day, tpd).
Table 10. Top ten primary active ingredients contributing to **2007** May-October ozone season *adjusted* VOC emissions in NAA 2, the San Joaquin Valley.
Table 11. Top ten pesticide application sites contributing to **2007** May-October ozone season *unadjusted* VOC emissions in NAA 2.
Table 12. *Unadjusted* **2007** May–October VOC emissions in NAA 2 by ARB emission inventory classification (tons per day, tpd).
Table 13. Top ten primary active ingredients contributing to **2007** May-October ozone season *adjusted* VOC emissions in NAA 3, the Southeast Desert
Table 14. Top ten pesticide application sites contributing to **2007** May-October ozone season *unadjusted* VOC emissions in NAA 3.
Table 15. *Unadjusted* **2007** May–October VOC emissions in NAA 3 by ARB emission inventory classification (tons per day, tpd).
Table 16. Top ten primary active ingredients contributing to **2007** May-October ozone season *adjusted* VOC emissions in NAA 4, Ventura.
Table 17. Top ten pesticide application sites contributing to **2007** May-October ozone season *unadjusted* VOC emissions in NAA 4.
Table 18. *Unadjusted* **2007** May–October VOC emissions in NAA 4 by ARB emission inventory classification (tons per day, tpd).
Table 19. Top ten primary active ingredients contributing to **2007** May-October ozone season *adjusted* VOC emissions in NAA 5, South Coast.
Table 20. Top ten pesticide application sites contributing to **2007** May-October ozone season *unadjusted* VOC emissions in NAA 5.
Table 21. *Unadjusted* **2007** May–October VOC emissions in NAA 5 by ARB emission inventory classification (tons per day, tpd).
Table 22. May–October (ozone season) non-fumigant pesticide VOC emissions.
Table 23. Preliminary projection for 2009 VOC emissions for NAAs 2, 3 and 4. The 2009 projected fumigant limits are determined by subtracting the 2007 nonfumigant emissions from the SIP goals and VOC regulation benchmarks.

LIST OF FIGURES

Figure 1. Federal nonattainment areas affected by California Regulations to reduce emissions from fumigant pesticides.
Figure 2. Annual ***unadjusted*** ozone season pesticide VOC emissions by NAA from 1990 to 2007, inclusive.
Figure 3. Annual ozone season pesticide VOC emissions by NAA. These figures show adjusted emissions, VOC regulation benchmarks (reductions from 1991 emissions) and SIP goals (reductions from 1990 emissions).

Figure 4. Pesticide VOC emissions for the Sacramento Metro NAA, May–October. Emissions for each year are divided into fumigants and nonfumigants. Fumigant emissions are *adjusted* to account for fumigation method.
Figure 5. Changes in adjusted emissions of selected AIs in the Sacramento Metro NAA from 2005 to 2007.
Figure 6. Changes in unadjusted emissions from selected commodities/sites in the Sacramento Metro NAA from 2005 to 2007.
Figure 7. Pesticide VOC emissions for the San Joaquin Valley NAA, May–October. Emissions for each year are divided into fumigants and nonfumigants. Fumigant emissions are *adjusted* to account for fumigation method.
Figure 8. Changes in adjusted emissions of selected AIs in the San Joaquin Valley NAA from 2005 to 2007.
Figure 9. Changes in unadjusted emissions from selected commodities/sites in the San Joaquin Valley NAA from 2005 to 2007.
Figure 10. Pesticide VOC emissions for the Southeast Desert NAA, May–October. Emissions for each year are divided into fumigants and nonfumigants. Fumigant emissions are *adjusted* to account for fumigation method.
Figure 11. Changes in adjusted emissions of selected AIs in the Southeast Desert NAA from 2005 to 2007.
Figure 12. Changes in unadjusted emissions from selected commodities/sites in the Southeast Desert NAA from 2005 to 2007.
Figure 13. Pesticide VOC emissions for the Ventura NAA, May–October. Emissions for each year are divided into fumigants and nonfumigants. Fumigant emissions are *adjusted* to account for fumigation method.
Figure 14. Changes in adjusted emissions of selected AIs in the Ventura NAA from 2005 to 2007.
Figure 15. Changes in unadjusted emissions from selected commodities/sites in the Ventura NAA from 2005 to 2007.
Figure 16. Pesticide VOC emissions for the South Coast NAA, May–October. Emissions for each year are divided into fumigants and nonfumigants. Fumigant emissions are *adjusted* to account for fumigation method.
Figure 17. Changes in adjusted emissions of selected AIs in the South Coast NAA from 2005 to 2007
Figure 18. Changes in unadjusted emissions from selected commodities/sites in the South Coast NAA from 2005 to 2007.
Figure 19. Pesticide VOC emissions for the San Joaquin Valley NAA, May–October.

OVERVIEW

Introduction

The Pesticide element of the 1994 State Implementation Plan requires the California Department of Pesticide Regulation (DPR) to develop and maintain an emission inventory to track pesticide Volatile Organic Chemical (VOC) emissions and to reduce emissions up to 20 percent from base year in five nonattainment areas (NAAs) in California. These five NAAs are defined as areas that do not meet the National Ambient Air Quality Standards for ozone as designated in the Clean Air Act. The scope of the VOC inventory allows DPR to estimate VOC emissions from agricultural and commercial structural pesticide applications within the state. To do this DPR calculates emissions for each year beginning with 1990, and updates these calculations annually based on most recent data. The inventory focuses on the peak ozone period between May 1 and October 31 for each year.

The VOC emission inventory is estimated based on pesticide use reports (PURs) that are collected by DPR. The inventory includes applications that are made for agricultural and structural use as defined by law. Included are all agricultural applications with the exception of home use, industrial use, institutional use, applications made for vector control purposes and veterinarian uses. Production agricultural use covers applications to approximately 400 commodities/crops. Non-production agricultural use includes applications to approx 20 sites including cemeteries, golf courses, parks, rights of way, etc. Structural use includes all applications by structural pest control businesses, regardless of site treated.

The key pesticide use report data used to calculate VOC emissions is given in Table 1. There are seven counties that are partially within NAAs. Because the location of non-production agricultural and non-agricultural applications are only given down to the county level, these types of applications need to be allocated to the portions of those seven counties so that their contribution to NAA emissions can be accurately determined. Using a Geographic Information System (GIS) and surrogate data such as population, roadways, waterways and power lines, proportional estimates have been derived for structural and rights-of-way applications. Commodity fumigations are allocated based on information provided by the California Agricultural Commissioners.

Table 1. Key information included in pesticide use reports that form the basis of DPR's VOC emission inventory.

Information	**Production Agriculture Report** (Each Application)	**Non-Production Agriculture Report and Non Agricultural Reports** (Monthly Summary of Applications)
Product Applied	Yes	Yes
Crop/Site Treated	Yes	Yes
Amount Applied	Yes – each application	Monthly Total
Date Applied	Date and Time	Month
Application Method	Yes	No
Acres/Units Treated	Yes	Monthly Total
Location of Application	Township/Range/Section	County

California's five ozone nonattainment areas (NAAs) are Sacramento Metro (1), San Joaquin Valley (2), Southeast Desert (3), Ventura (4), and South Coast (5). The boundaries of these NAAs, as defined by CFR 40 Part 81, and a listing of counties that fall within the boundaries are shown in Figure 1 and Table 2, respectively.

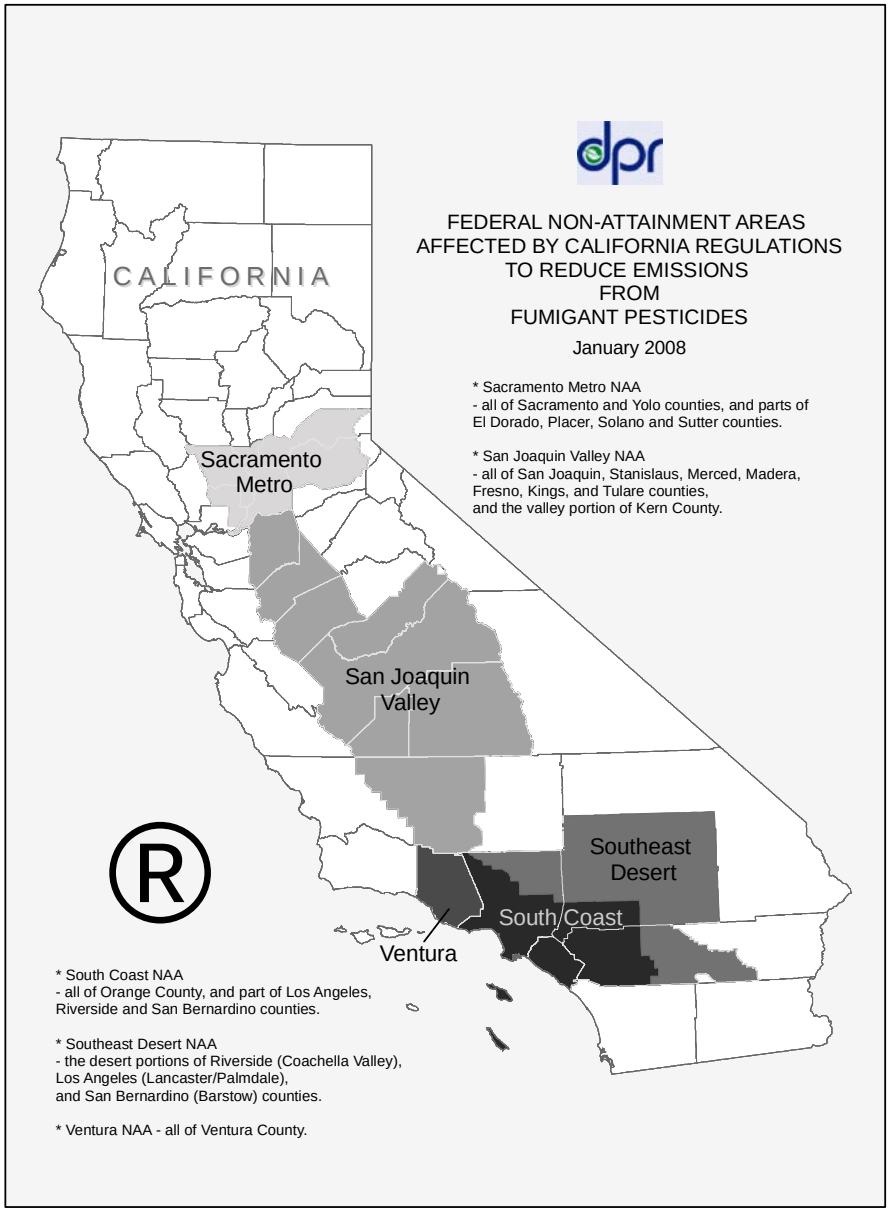


Figure 1. Federal nonattainment areas affected by California Regulations to reduce emissions from fumigant pesticides.

Table 2. A listing of counties wholly or partially within nonattainment areas in California.

NAA	Counties within the NAA
1 – Sacramento Metropolitan	All of Sacramento, Yolo Parts of Sutter, Solano, Placer, El Dorado
2 – San Joaquin Valley	All of Fresno, Kings, Madera, Merced, San Joaquin, Stanislaus, Tulare Western Part of Kern
3 – Southeast Desert	Parts of Los Angeles, San Bernardino, Riverside
4 – Ventura	All of Ventura
5 – South Coast	All of Orange Western Parts of Los Angeles, San Bernardino, Riverside

Nonattainment Area Goals

The emissions in DPR's VOC inventory are compared to two sets of NAA goals (Table 3). The first set of goals are those required by an April 26, 2006, federal district court order (now overturned), and reflected in Title 3, California Code of Regulations section 6452.2. These are the goals shown as the "VOC regulation benchmarks" and are calculated as a 20 percent reduction from the pesticide VOC emissions in 1991 for all NAAs. The VOC regulations contain a provision specific to Ventura that allows a phase-in of the 20 percent VOC reductions from 1991 levels between 2008 and 2012. However, an August 20, 2008 decision by the Ninth Circuit Court of Appeals reversed the district court action, finding that it had no jurisdiction to issue its order. Consequently the second set goals are those described in California's original 1994 State Implementation Plan (SIP) (62 Fed. Reg. at 1170,1997) and Appendix H to the 2007 SIP (73 Fed. Reg. 41277, 2008). These "SIP goals" are a 20 percent reduction from 1990 for the Sacramento Metro, Southeast Desert, and South Coast NAAs; a 12 percent reduction from 1990 for the San Joaquin Valley NAA; and a phase-in of the reductions for the Ventura NAA, with a final reduction for Ventura of 20 percent from 1990 by 2012.

Table 3. Nonattainment Area Goals for 2009 – 2012.

NAA	VOC Regulation Benchmark (tons/day) 2009-2012				SIP Goal (tons/day) 2009 - 2012			
1 – Sacramento Metropolitan	2.4				2.234			
2 – San Joaquin Valley	16.0				18.139			
3 – Southeast Desert	0.62				0.923			
4 – Ventura	**2009**	**2010**	**2011**	**2012**	**2009**	**2010**	**2011**	**2012**
	3.630	3.230	2.930	2.600	4.030	3.630	3.330	3.029
5 – South Coast	4.1				8.672			

Procedure For Calculating Unadjusted and Adjusted VOC Emissions

To date, DPR has reported an unadjusted emission inventory that assumes the entire volatile portion of a fumigant product eventually volatilizes, contributing to atmospheric VOC loadings. However, several dozen field studies have shown that actual emissions from soil-applied fumigants such as methyl bromide vary by application method and are generally less than 100 percent. DPR has developed an adjustment procedure to account for the effect of application method on reducing fumigant VOC emissions.

The unadjusted inventory is based on the premise that the VOC emission from a single application of fumigant or non-fumigant product is equal to the amount used times the Emission Potential (EP) (Spurlock, 2002; 2006).

$$emission = lbs\ of\ product\ used \times EP$$

In the adjusted inventory the emission from a single application of a **fumigant** active ingredient (AI) is reduced by an additional factor called the Application Method Adjustment Factor (AMAF), also referred to as the emission rating. AMAFs have been determined from field study data and are AI and application method specific (Barry et al., 2007). Since the AMAFs are based on field measured data for specific application methods and fumigants, they yield more refined estimates of fumigant VOC emissions than the previous unadjusted emission estimates

$$emission = lbs\ of\ product\ used \times EP \times AMAF$$

In the adjusted inventory, **nonfumigant** product emissions are not currently adjusted for application method or other field factors due to a lack of data to support such adjustments. Consequently their emissions are calculated using the same procedure as the unadjusted inventory.

Usually there are several different types of application methods used for a particular fumigant in any particular NAA. Each method of use (e.g. drip, sprinkler, shank, tarp, etc.) represents a fraction of the total number of methods used and is referred to as the Method Use Fraction (MUF). The sum of all *MUFs* for any particular (NAA/fumigant AI) combination is one. Use practices change over time so that different *MUF*s are used for the baseline year (1990) as opposed to more recent inventory years. *MUF*s are determined in a number of different ways. For 1,3- dichloropropene the *MUF*s are determined from use data collected by the registrant in support of DPR's township application caps; for metam sodium and metam potassium grower/applicator surveys were conducted to determine types of applications for different crops and areas. Methyl bromide and chloropicrin *MUF*s are based on expert opinion and regulatory history. Finally, *MUF*s for dazomet and sodium tetrathiocarbonate equal one because the *AMAF*s

for each of these two fumigants are constant, independent of application method. A detailed discussion of how MUF and AMAFs were determined is given by Barry et al (2007). The AMAFs and method use fractions for 1990, 2005, 2006 and 2007 in each of the nonattainment areas are included in the appendix of this document (Tables A1 – 1 to A1 - 21), and are those given by Barry et al. (2007).

VOC emissions were calculated for each nonattainment area and summed according to primary active ingredient, application site, and emission category as defined by the Air Resources Board (ARB). The primary active ingredient is defined as the pesticide active ingredient present at the highest percentage in a product. If a pesticide product contains 20 percent of active ingredient "A" and 10 percent of active ingredient "B", all estimated emissions from that product are assigned to the primary active ingredient "A". This approach prevents "double-counting" of emissions from products containing two active ingredients.

Both unadjusted and adjusted emission inventory data for the top ten primary active ingredients contributing to May-October ozone in 2005, 2006 and 2007 are included in this memo. Appendix 2 contains summaries of emissions attributable to specific application sites (or commodities). These summary data are provided only for *unadjusted* emissions because it is not possible to allocate adjusted emissions to specific application sites with the currently available data.

The Air Resources Board defines four VOC emission categories: methyl bromide emissions from agricultural applications, non-methyl bromide emissions from agricultural applications, methyl bromide emissions from structural applications, and non-methyl bromide emissions from structural applications. Emissions were calculated for the May – October ozone season, and are reported as U.S. tons per day (tpd).

Revised Emission Potential Values and New Method Use Fractions

DPR continually evaluates pesticide use report data, emission potential (EP) values, Method Use Fractions (MUF) and Application Method Adjustment Factors (AMAF) to ensure the VOC inventory includes the most reliable data. Propylene oxide, for example, is used exclusively for post-harvest fumigation, and is widely used in the Sacramento Metro and San Joaquin Valley NAAs. In the past DPR has included these applications in its VOC inventory. However, since the Air Pollution Control Districts also include these uses in their inventories emissions are being double counted. In addition, DPR has concluded that the use of propylene oxide is not an agricultural use, and therefore its products have been eliminated from DPR's VOC inventory.

Recent findings by U.S. Department of Agriculture (McConnell et al., 2008) indicate that dust/powder sulfur formulations have zero emission potential. Most of these products had low emission potential values in previous inventories, but because of their high use the impact on the VOC inventory was significant. As a result, emission potentials for all sulfur products with dust/powder formulations that do not contain any organic components have been set to zero.

In 2008 DPR and registrants identified an anomalously high emission potential for a certain high use spray oil product. In response DPR re-reviewed the initial thermogravimetric (TGA) analyses of the oil products 10951-15 (Britz 415 Supreme Spray Oil and Britz Citrus Supreme Spray Oil; EP = 23.95) and 11656-97 (First Choice Narrow Range 415 Spray Oil and Leaf Life Gavicide Green 415; EP = 19.98) and determined that the TGA data were unacceptable because the TGA experimental conditions deviated significantly from DPR's experimental protocol (McKinney, 2008). Therefore the emission potential for these products is equal to the spray oil special default value of 1.53 until valid TGA data is received. A TGA data reporting error was also identified for product 48813-1 (Saf-T-Side products and Synergy Super Fine Spray Oil Emulsion). After correctly accounting for the water content of the product, the experimental TGA-measured VOC emission potential value of the product and all of its ten sub-registration products are now equal to zero (water is not a VOC). The net effect of this latter change on the inventory was minor because these products have very low use.

Regulations to reduce emissions of volatile organic compounds (VOCs) from fumigant pesticides went into effect in January 2008. Under the rules, in certain areas of the state, only specific application methods that have estimated emission ratings can be used during May 1 to October 31. The regulations, Title 3, CCR section 6452, include a provision for the DPR Director to grant interim approval of fumigation methods that reduce VOC emissions. As part of DPR's efforts to reduce volatile organic compound (VOC) emissions, most night applications of methyl isothiocyanate (MITC)-containing pesticides are prohibited within several ozone nonattainment areas (NAAs) during May–October, under Title 3, California Code of Regulations (3 CCR) section 6450.1(c). Title 3, CCR section 6452 sets different standards by which to evaluate whether a new fumigation method will be allowed, one for the Sacramento Metro and South Coast ozone NAAs and one for the San Joaquin Valley, Southeast Desert, and Ventura ozone NAAs. Sacramento Metro and South Coast have a less stringent standard because no further VOC reductions from pesticides are needed in these ozone NAAs. Both "low-emission" and "high-emission" fumigant application methods can be used in these two areas. Only "low-emission" methods are allowed in the San Joaquin Valley, Southeast Desert, and Ventura ozone NAAs during the May–October peak ozone season.

DPR has reviewed submitted information and effective May 1, 2008 approved the interim use of the MITC night shallow injection method in all five ozone NAAs, the MITC night sprinkler method is approved for use in the Sacramento Metro and South Coast ozone NAAs, but not the San Joaquin Valley, Southeast Desert, or Ventura ozone NAAs during May–October. These fumigation methods may be used anytime outside of ozone NAAs and within any ozone NAA outside the May–October period, consistent with all VOC fumigation method restrictions. The following fumigation codes on the Pesticide Use Reporting and the Field Fumigant VOC Emission Allowance forms are described in Table 4. Details regarding the decisions and data reviews for these methods can be found at http://www.cdpr.ca.gov/docs/emon/vocs/vocproj/decision_review.pdf.

Table 4. Method codes and emission ratings for night applications of MITC application methods.

Method code	Emission Rating (%)	Regulation Section Field Fumigation Method
1452	77	6452 (b)(1) Night Sprinkler/Broadcast or Bed/ Two Water Treatments
1455	28	6452 (b)(1) Night Nontarpaulin/Shallow/Broadcast or Bed/ Two Water Treatments

Effective August 1, 2008, DPR granted approval for interim use of a metam 4:00 a.m. start chemigation method in all five ozone NAAs. Rate restrictions of 290 pounds A.I. per acre for metam-potassium applications and 260 pounds A.I. per acre for metam-sodium applications rate were added for the San Joaquin Valley, Southeast Desert, and Ventura ozone NAAs.

The following fumigation codes on the Pesticide Use Reporting and the Field Fumigant VOC Emission Allowance forms are described in Table 5. Details regarding the decisions and data reviews for this method can be found at http://www.cdpr.ca.gov/docs/emon/vocs/vocproj/decision081308.pdf.

Table 5. Method codes and emission ratings for sprinkler 4am start MITC application method.

Method code	Emission Rating (%)	Regulation Section Field Fumigation Method
1472	35	6452 (b)(1) Night 4 A.M. Start/Sprinkler/Broadcast or Bed/Two Water Treatments

Tables of field fumigation methods allowed, by geographic region, under the new regulations are included in Appendix 4. Restrictions on fumigation methods are in effect May 1 through October 31, in certain geographic areas (see Appendix 4 Tables). From November through April, any label method may be used, anywhere in California. (Regulations and permit conditions that already restricted the use of fumigants still apply.) Detailed descriptions of each method can be found at http://www.cdpr.ca.gov/docs/emon/vocs/vocproj/desc_fieldfum_mthd.htm.

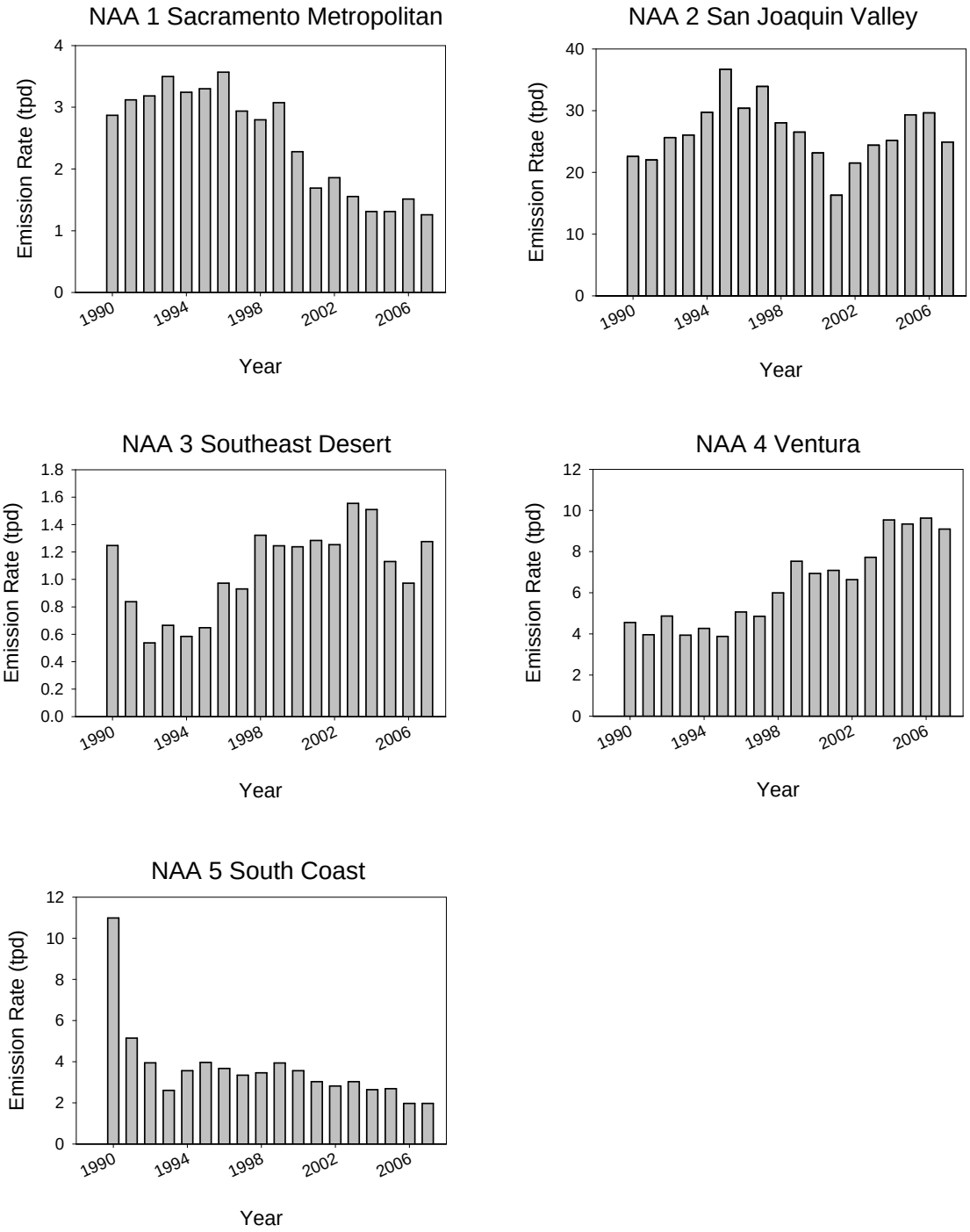
VOLATILE ORGANIC COMPOUND INVENTORY RESULTS

The main text of this report summarizes the pesticide VOC emission inventory data for 2007 only. Adjusted and unadjusted emission data for 2005 and 2006, and unadjusted data for 2007 are summarized in Appendices 2 and 3. Previous inventory memos included a summary of pesticide VOC emissions by commodity/site. At this time it is not possible to determine the breakdown of adjusted emissions by commodity, so only the *unadjusted* emissions are shown by commodity. Tables for emissions calculated for

active ingredients (adjusted and unadjusted) and application sites (unadjusted) contain information for the top ten contributors only.

Figure 2 illustrates the changes in *unadjusted* VOC emissions from 1990 to 2007. These values are *unadjusted* and so do not take in to consideration MUFs and AMAFs that can only be applied to emissions in 2005 through 2007, and 1990/1991. The figure is useful in that it compares emissions for the entire history of the inventory and shows increasing, in the case of Southeast Desert and Ventura NAAs, and decreasing (Sacramento Metro and South Coast NAAs) trends.

Figure 2. Annual ***unadjusted*** ozone season pesticide VOC emissions by NAA from 1990 to 2007, inclusive.



Tables 6a and 6b and Figure 3 summarize the adjusted pesticide VOC emissions for 2004 through 2007, and compare them to two sets of goals: the regulatory goals (benchmarks) that are based upon a percentage reduction from the 1991 base year, and; the SIP goals that based a percentage reduction from the 1990. The emissions in the base year are also included to reflect the long term decrease or increase (only Ventura NAA over 1991 base year) from the two base years. Generally, what the tables and figure show can be summarized as follows:

- Decreasing emissions in the Sacramento Metro (1) show a positive (declining) trend. VOC emissions increased between 2004 and 2006, but decreased in 2007, with non-fumigants representing 82 percent of the total, and the total remaining well below either goal.
- Decreasing emissions in the South Coast NAA (5) also show a positive trend. VOC emissions decreased and remain well below either emission goal.
- Since 2004, fumigants continue to account for over two thirds of VOC emissions in the Southeast Desert (3). VOC emissions decreased annually through 2006, but then increased in 2007. Emissions continue to meet the SIP goal, but exceed the regulatory goal.
- VOC emissions in the Ventura NAA (4) have decreased since 2004 but do not meet either the regulatory goal or SIP goal for 2012. 2007 emissions do meet the regulatory goal for 2009. More than 85 percent of emissions come from fumigants.
- In the San Joaquin Valley NAA (2), consistent with previous years, non-fumigants accounted for approximately two thirds of the total VOC emissions. In this NAA, VOC emissions increased in 2005 and 2006 and then decreased to below 2004 levels in 2007. The 2007 emissions are below the SIP goal, but exceed the regulatory goal by 1.279 tpd[2].

[2] In almost all cases, it is the solvents included as inert ingredients of non- fumigant emulsifiable concentrates that contribute most of the VOCs, not the active ingredients.

Table 6a. May–October (ozone season) *adjusted* pesticide VOC emissions and goals.

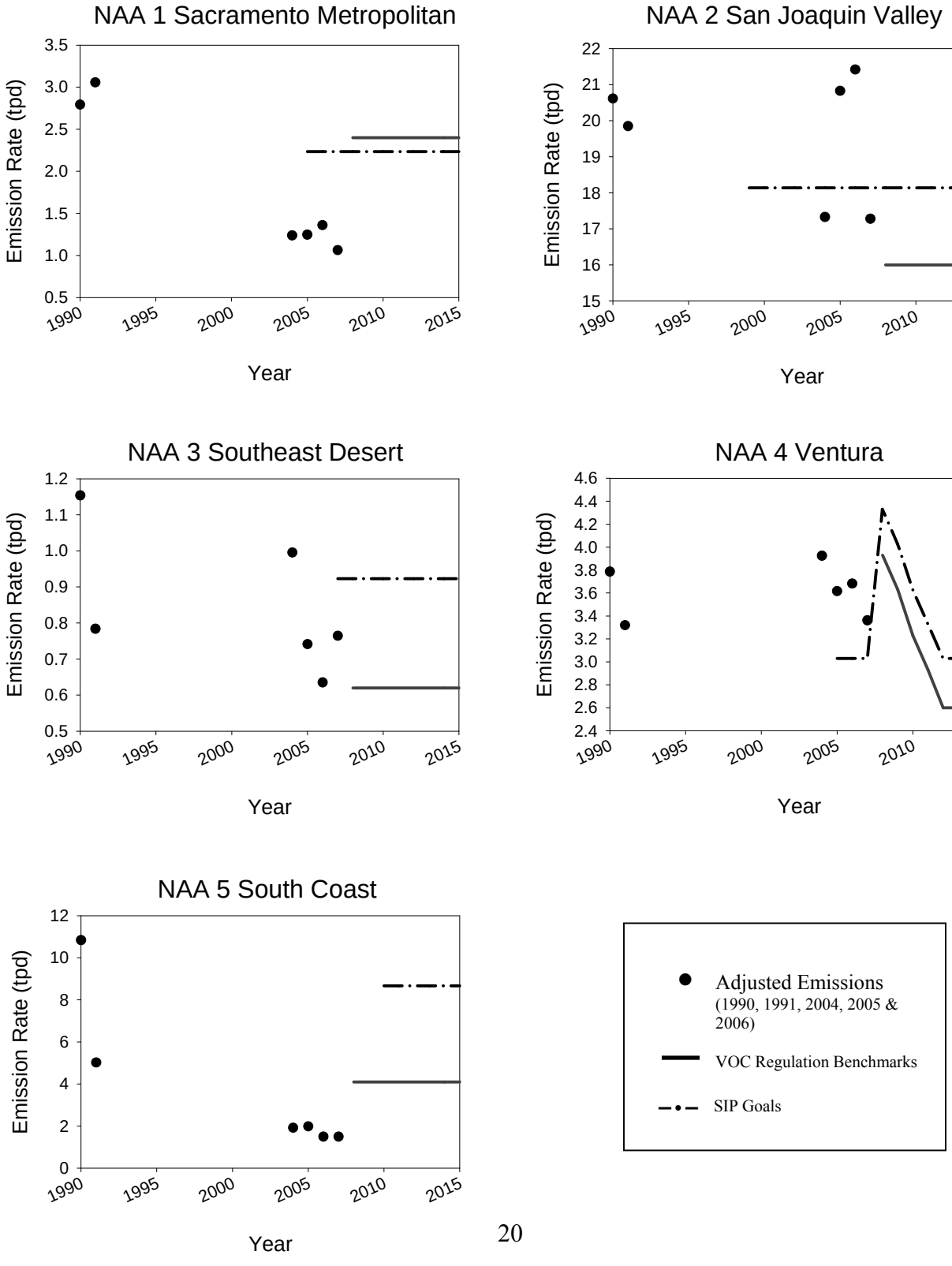
NAA	1990 Emissions (tons/day)	1991 Emissions (tons/day)	SIP Goal (tons/day)	VOC Regulation Benchmark (tons/day)	2004 Emissions (tons/day)	2005 Emissions (tons/day)	2006 Emissions (tons/day)	2007 Emissions (tons/day)
1 – Sacramento Metropolitan	2.792	3.056	2.234	2.4	1.238	1.246	1.359	1.062
2 – San Joaquin Valley	20.612	19.847	18.139	16.0	17.327	20.828	21.419	17.279
3 – Southeast Desert	1.154	0.784	0.923	0.62	0.995	0.741	0.635	0.764
4 – Ventura	3.787	3.320	3.029 a	2.6 a	3.924	3.616	3.682	3.361
5 – South Coast	10.840	5.020	8.672	4.1	1.922	1.984	1.492	1.495

a These numbers reflect the SIP goal and VOC Regulation Benchmark for 2012 in Ventura, and do not reflect the phase in of reductions between 2008 and 2012.

Table 6b. May–October (ozone season) fumigant and non-fumigant pesticide VOC emissions.

NAA	1990 Emissions (tons/day)	1991 Emissions (tons/day)	2004 Emissions (tons/day)	2005 Emissions (tons/day)	2006 Emissions (tons/day)	2007 Emissions (tons/day)
1 – Sacramento Metro						
Fumigants	0.384 (14%)	0.317 (10%)	0.111 (9%)	0.085 (7%)	0.162 (12%)	0.191 (18%)
Non-Fumigants	2.408 (86%)	2.739 (90%)	1.126 (91%)	1.161 (93%)	1.197 (88%)	0.871 (82%)
2 - San Joaquin Valley						
Fumigants	5.536 (27%)	7.164 (36%)	6.362 (37%)	6.910 (33%)	6.808 (32%)	6.146 (36%)
Non-Fumigants	15.076 (73%)	12.682 (64%)	10.965 (63%)	13.918 (67%)	14.611 (68%)	11.134 (64%)
3 - Southeast Desert						
Fumigants	0.840 (73%)	0.401 (51%)	0.762 (77%)	0.474 (64%)	0.413 (65%)	0.575 (75%)
Non-Fumigants	0.313 (27%)	0.383 (49%)	0.233 (23%)	0.267 (36%)	0.222 (35%)	0.189 (25%)
4 - Ventura						
Fumigants	3.140 (83%)	2.751 (83%)	3.302 (84%)	3.119 (86%)	3.175 (86%)	2.933 (87%)
Non-Fumigants	0.647 (17%)	0.568 (17%)	0.622 (16%)	0.497 (14%)	0.508 (14%)	0.428 (13%)
5 – South Coast						
Fumigants	9.372 (86%)	3.614 (72%)	0.702 (37%)	0.597 (30%)	0.422 (28%)	0.411 (28%)
Non-Fumigants	1.468 (14%)	1.406 (28%)	1.220 (63%)	1.387 (70%)	1.069 (72%)	1.084 (72%)

Figure 3. Annual ozone season pesticide VOC emissions by NAA. These figures show adjusted emissions, VOC regulation benchmarks (reductions from 1991 emissions) and SIP goals (reductions from 1990 emissions).



Sacramento Metropolitan Area - NAA 1

The Sacramento Metro NAA (NAA1) 2007 emissions are below those of the three previous years. Adjusted emissions in 2004 were 1.238 tpd, and these increased to 1.359 tpd in 2006 and decreased to 1.062 tpd in 2007. In 2007, 82 percent of emissions were attributable to non-fumigants. Fumigant emissions have increased from seven percent (0.085 tpd) in 2005 to 18 percent in 2007 (0.191 tpd) (Tables 6a, 6b, Figure 3, 4). Total VOC emissions continue to remain well below the SIP goal and the VOC regulation benchmark.

Chlorpyrifos, a widely used insecticide, was a primary contributor and accounted for more than ten percent of the emissions in 2007 (Table 7). Emissions from chlorpyrifos use decreased from 0.186 tpd in 2005 to 0.116 tpd in 2007. Emissions from the use of 1,3-dichloropropene have increased steadily since 2005 (0.024 tpd), and in 2007 accounted for 0.109 tpd (10.26%). Methyl bromide emissions have also increased since 2005. The rice herbicide molinate accounted for the second highest amount of emissions in 2005 (0.093 tpd), however molinate use is being phased out which is reflected by a further reduction in emissions in 2007 to 0.011 tpd. This result is consistent with reported use in NAA 1, which decreased from over 150,000 pounds AI used in 2004 to 52,000 pounds in 2005, just over 30,000 lbs in 2006, and 14,000 lbs in 2007. Emissions from metam-sodium, a pre-plant fumigant, increased from 0.028 tpd in 2005 to 0.063 tpd in 2006, but decreased to 0.022 tpd in 2007 (Tables 7, A3-1a, A3-1b, A3-1c, Figure 5).

In 2007 walnuts were the commodity/site with the greatest unadjusted VOC emissions with over 20 percent of the total. Detailed analysis of the data indicates the total acreage of walnuts has remained largely unchanged since 2005, but that the amount of VOC emissions derived from applications of 1,3-dichloropropene and methyl bromide to walnuts have increased by a factor of twenty and ten between 2005 and 2007, respectively. Emissions from rice, processing tomatoes, and structural pest control declined in 2007 (Tables 8, A2-1d, A2-1e, A2-1f, Figure 6).

Using the ARB emission inventory classification, emissions from structural applications of methyl bromide remained steady at less than 0.001 tpd since 2005, but agricultural applications have increased from 0.035 tpd in 2005 to 0.037 tpd in 2006 and almost doubled to 0.062 tpd in 2007. These findings are consistent with the trend found for increased applications of methyl bromide to walnuts. Non-methyl bromide emissions from structural applications declined rapidly from approximately 0.22 tpd in 2005 and 2006 to 0.66 tpd (Tables 9, A2-1g, A2-1h, A2-1i).

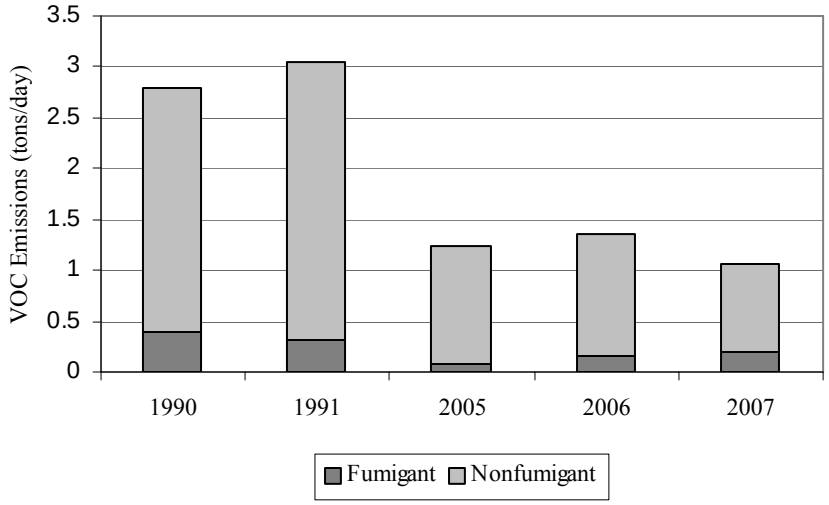


Figure 4. Pesticide VOC emissions for the Sacramento Metro NAA, May–October. Emissions for each year are divided into fumigants and nonfumigants. Fumigant emissions are *adjusted* to account for fumigation method.

Table 7. Top ten primary active ingredients contributing to **2007** May-October ozone season *adjusted* VOC emissions in NAA 1, the Sacramento Metropolitan Area.

Primary AI	**Total Product Adjusted Emissions (tons/day)**	**Percent of All NAA 1 May – Oct 2007 Adjusted Emissions**
CHLORPYRIFOS	0.116	10.95
1,3-DICHLOROPROPENE	0.109	10.26
TRIFLURALIN	0.057	5.40
METHYL BROMIDE	0.055	5.19
DIMETHOATE	0.049	4.66
THIOBENCARB	0.039	3.70
OXYFLUORFEN	0.038	3.57
PROPANIL	0.029	2.72
PENOXSULAM	0.027	2.51
ETHALFLURALIN	0.025	2.40

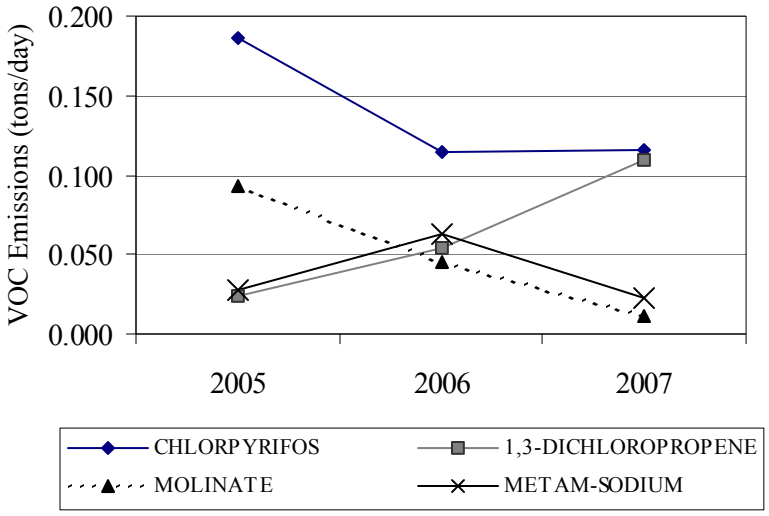


Figure 5. Changes in adjusted emissions of selected AIs in the Sacramento Metro NAA from 2005 to 2007.

Table 8. Top ten pesticide application sites contributing to **2007** May-October ozone season *unadjusted* VOC emissions in NAA 1.

Application Site	**Emissions (tons/day)**	**Percent of all NAA 1 May – Oct 2007 emissions**
WALNUT	0.300	23.86
RICE	0.160	12.73
TOMATO, PROCESSING	0.143	11.39
RIGHTS OF WAY	0.076	6.03
STRUCTURAL PEST CONTROL	0.066	5.28
SOIL FUMIGATION/PREPLANT	0.061	4.83
N-OUTDR PLANTS IN CONTAINERS	0.053	4.23
LANDSCAPE MAINTENANCE	0.047	3.71
UNCULTIVATED AG	0.045	3.60
GRAPE, WINE	0.043	3.39

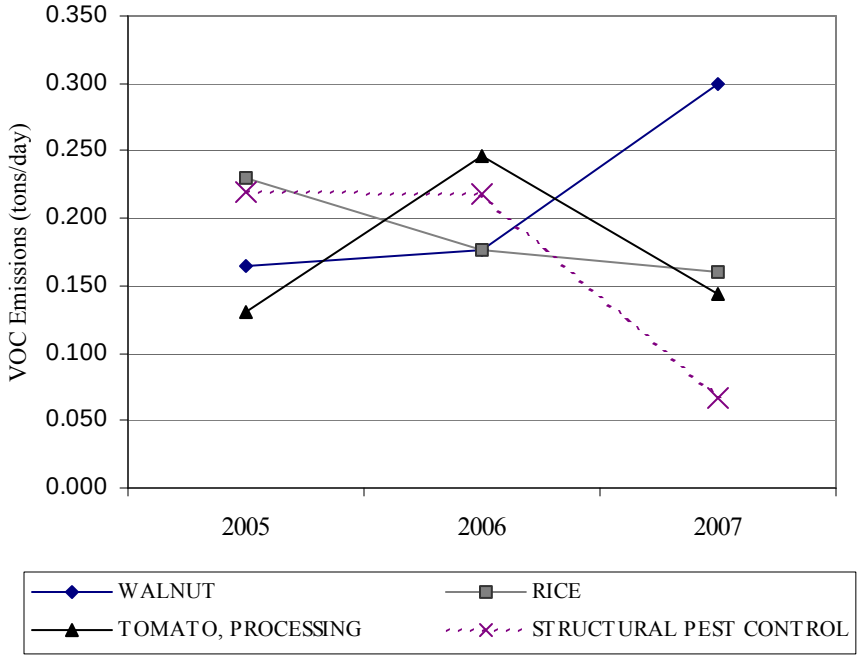


Figure 6. Changes in unadjusted emissions from selected commodities/sites in the Sacramento Metro NAA from 2005 to 2007.

Table 9. *Unadjusted* **2007** May–October VOC emissions in NAA1 by ARB emission inventory classification (tons per day, tpd).

NAA 1 - 2007	**Agricultural Applications**	**Structural Applications**
METHYL BROMIDE EMISSIONS	0.062	0.000
NON-METHYL BROMIDE EMISSIONS	1.124	0.066

San Joaquin Valley - NAA 2

Adjusted emissions in 2004 were 17.327 tpd and increased in 2005 to 20.828 tpd, and 21.419 tpd in 2006. However, 2007 emissions showed a marked decline to 17.279 tpd. All three years' emissions are above the VOC regulation benchmark of 16 tpd, but the 2007 emissions are below the SIP goal of 18.139 tpd (Tables 6a, 6b, Figure 3, 7).

Fumigants accounted for between 31.8 and 35.6 percent of adjusted emissions for the three years. The top emission contributor for 2005 through 2007 was the nonfumigant, chlorpyrifos, which accounted for 3.868 and 3.990 tpd in 2005 and 2006, respectively, but fell to 2.263 tpd in 2007. (Tables 10, A3-2a, A3-2b, A3-2c, Figure 7). Almost fifty percent of emissions from chlorpyrifos came from use on cotton and almonds. In 2005, almost 30 percent of chlorpyrifos emissions came from cotton, but the cotton contribution to chlorpyrifos emissions dropped to 20 percent in 2006 and only 6 percent in 2007. Conversely, emissions from chlorpyrifos use on almonds increased from 17 percent in 2005 to 37 percent in 2006 and 43 percent in 2007. Fumigant use on carrots, in the form of metam-sodium, 1,3-dichloropropene and potassium N-methyldithiocarbamate,

accounted for more than 90 percent of emissions from this commodity (Tables 11, A2-2d, A2-2e, A2-2f, Figure 9).

Using the ARB emission inventory classification, emissions from structural applications of methyl bromide increased from 0.008 tpd in 2005 to 0.029 tpd in 2006, but decreased to 0.012 tpd in 2007. Agricultural applications remained consistently around 2 tpd over the three-year period. Non-methyl bromide emissions from both structural and agricultural applications have declined significantly between 2006 and 2007 to 22.210 tpd and 0.291 tpd, respectively (Tables 12, A2-2g, A2-2h, A2-2i).

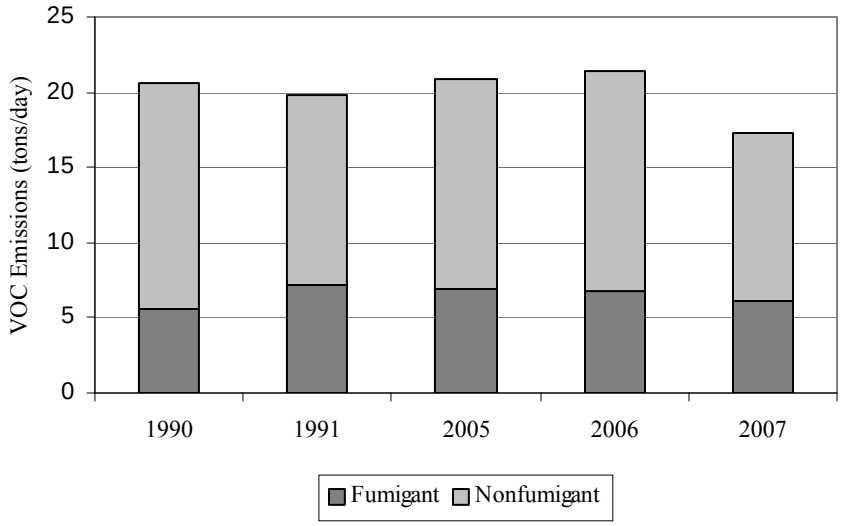


Figure 7. Pesticide VOC emissions for the San Joaquin Valley NAA, May–October. Emissions for each year are divided into fumigants and nonfumigants. Fumigant emissions are *adjusted* to account for fumigation method.

Table 10. Top ten primary active ingredients contributing to **2007** May-October ozone season *adjusted* VOC emissions in NAA 2, the San Joaquin Valley.

Primary AI	**Total Product Adjusted Emissions (tons/day)**	**Percent of All NAA 2 May – Oct 2007 Adjusted Emissions**
CHLORPYRIFOS	2.263	13.10
1,3-DICHLOROPROPENE	2.169	12.55
METAM-SODIUM	2.088	12.08
METHYL BROMIDE	1.005	5.82
OXYFLUORFEN	0.944	5.46
GIBBERELLINS	0.712	4.12
POTASSIUM N-METHYLDITHIOCARBAMATE	0.650	3.76
DIMETHOATE	0.643	3.72
ABAMECTIN	0.542	3.14
ACROLEIN	0.455	2.63

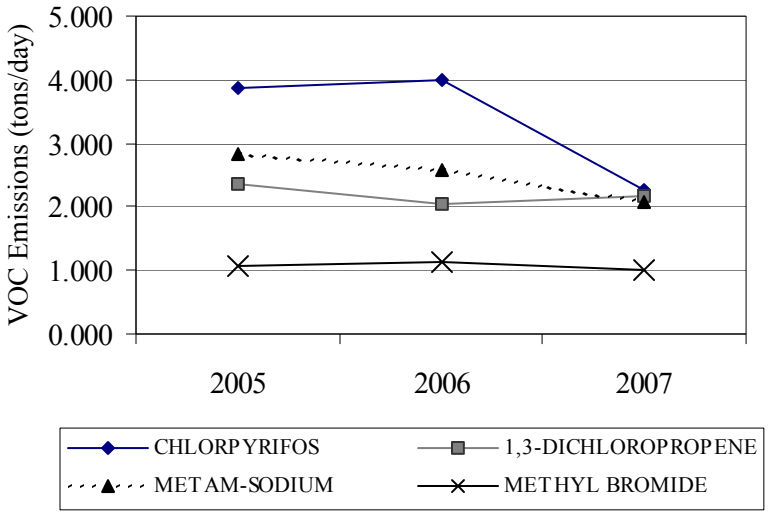


Figure 8. Changes in adjusted emissions of selected AIs in the San Joaquin Valley NAA from 2005 to 2007.

Table 11. Top ten pesticide application sites contributing to **2007** May-October ozone season *unadjusted* VOC emissions in NAA 2.

Application Site	**Emissions (tons/day)**	**Percent of all NAA 2 May – Oct 2007 emissions**
CARROT	3.943	15.89
ALMOND	3.922	15.80
GRAPE	1.400	5.64
ORANGE	1.303	5.25
N-OUTDR PLANTS IN CONTAINERS	1.068	4.30
WALNUT	1.063	4.28
COTTON	1.049	4.23
POTATO	0.942	3.79
SOIL FUMIGATION/PREPLANT	0.774	3.12
TOMATO, PROCESSING	0.764	3.08

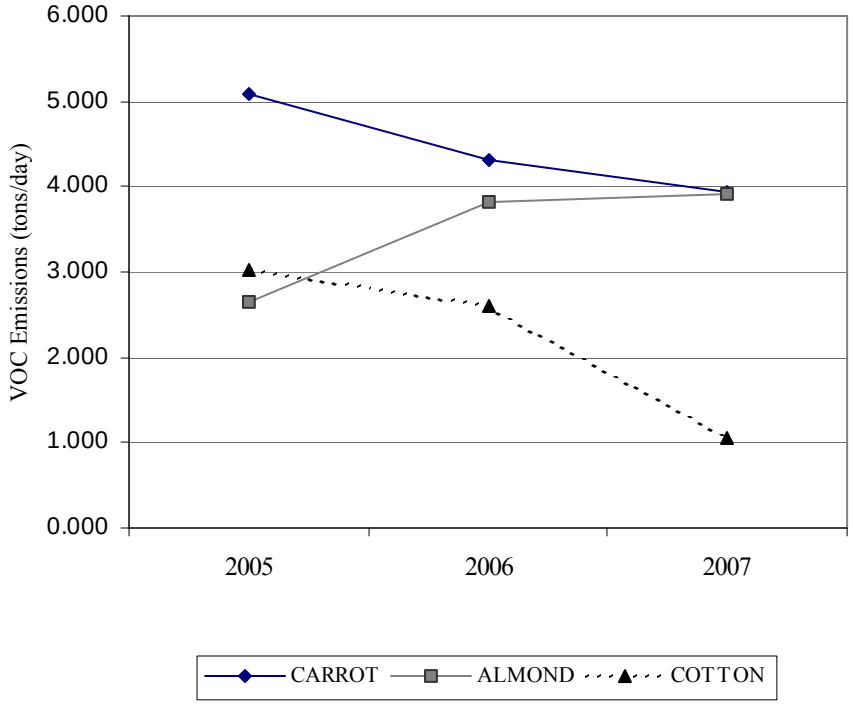


Figure 9. Changes in unadjusted emissions from selected commodities/sites in the San Joaquin Valley NAA from 2005 to 2007.

Table 12. *Unadjusted* **2007** May–October VOC emissions in NAA 2 by ARB emission inventory classification (tons per day, tpd).

NAA 2 - 2007	**Agricultural Applications**	**Structural Applications**
METHYL BROMIDE EMISSIONS	1.905	0.012
NON-METHYL BROMIDE EMISSIONS	22.210	0.291

Southeast Desert - NAA 3

Total adjusted emissions for the Southeast Desert declined steadily from 0.995 tpd in 2004 to 0.635 tpd in 2006, but increased to 0.754 tpd in 2007. The 2007 rate is below the SIP goal of 0.923 tpd, but above the VOC regulation benchmark of 0.62 tpd (Tables 6a, 6b, Figure 3, 10).

Fumigants account for at least two thirds of the emissions in this NAA. Metam-sodium is the primary contributor, accounting for an average of 46.3 percent of the adjusted emissions over the three years. The increased percentage to 53.2 percent in 2006 corresponds to a reduction in the adjusted methyl bromide emissions from 0.048 tpd in 2005 to less than 0.008 tpd in 2006 (Tables 13, A3-3a, A3-3b, A3-3c, Figure 11). Although emissions from metam-sodium use varied by only about one hundredth of a ton per day over the years 2005 – 2007, there were significant changes in use of metam-sodium on potatoes, peppers (fruiting) and carrots. In 2005, approximately 25 percent of emissions from metam-sodium were from carrots, but in 2007 there was no reported use

of metam-sodium on carrots during the ozone season. Conversely, emissions from metam-sodium use on peppers and potatoes doubled from 2005 to 2007. Methyl bromide emissions increased to 0.170 tpd in 2007 and are responsible for the increase in total adjusted emissions in this NAA. The primary contributor to this increase is emissions from applications to turf/sod. No emissions from this commodity/site were reported in 2005 or 2006, but in 2007 approximately 65 percent of emissions from methyl bromide came from turf/sod. A secondary source of voc emissions from methyl bromide was from applications to peppers (fruiting) (Tables 14, A2- 3d, A2-3e, A2-3f, Figure 12).

Using the ARB emission inventory classification, emissions from structural applications of methyl bromide remained steady at less than 0.001 tpd since 2005, but agricultural applications decreased from 0.081 tpd in 2005 to 0.013 tpd in 2006 and increases significantly to 0.286 tpd in 2007. These findings are consistent with the trend found for the use of methyl bromide to turf/sod. Non-methyl bromide emissions from agricultural applications remained consistently around 0.89 tpd, whereas structural non-methyl bromide emissions have been reduced by about 50 percent between 2005 and 2007 from 0.130 tpd to 0.061 tpd (Tables 15, A2-3g, A2-3h, A2-3i).

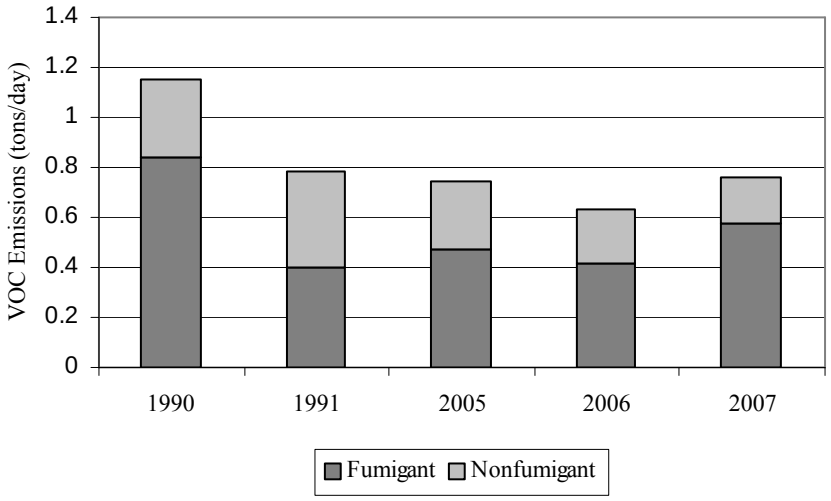


Figure 10. Pesticide VOC emissions for the Southeast Desert NAA, May–October. Emissions for each year are divided into fumigants and nonfumigants. Fumigant emissions are *adjusted* to account for fumigation method.

Table 13. Top ten primary active ingredients contributing to **2007** May-October ozone season *adjusted* VOC emissions in NAA 3, the Southeast Desert

Primary AI	**Total Product Adjusted Emissions (tons/day)**	**Percent of All NAA 3 May – Oct 2007 Adjusted Emissions**
METAM-SODIUM	0.323	42.32
METHYL BROMIDE	0.170	22.22
1,3-DICHLOROPROPENE	0.036	4.74
PERMETHRIN	0.020	2.65
BENSULIDE	0.017	2.18

EPTC	0.010	1.26
GLYPHOSATE, ISOPROPYLAMINE SALT	0.008	1.09
MALATHION	0.008	1.05
MEFENOXAM	0.007	0.94
METHOMYL	0.006	0.84

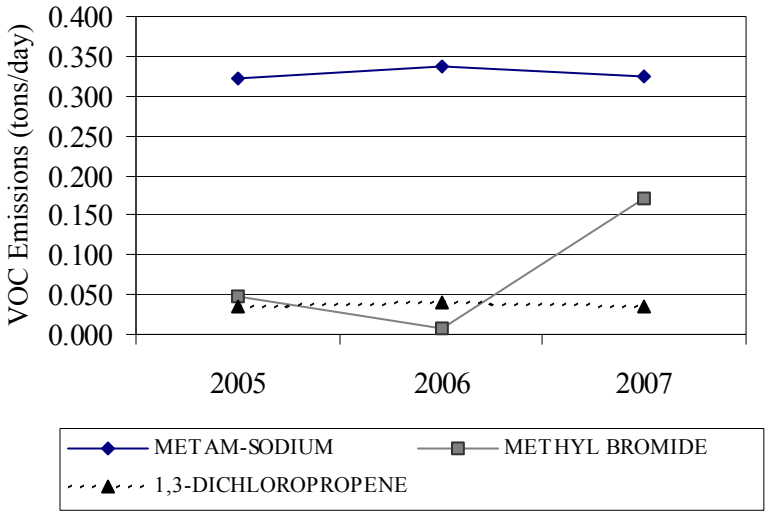


Figure 11. Changes in adjusted emissions of selected AIs in the Southeast Desert NAA from 2005 to 2007.

Table 14. Top ten pesticide application sites contributing to **2007** May-October ozone season *unadjusted* VOC emissions in NAA 3.

Application Site	**Emissions (tons/day)**	**Percent of all NAA 3 May – Oct 2007 emissions**
PEPPER, FRUITING	0.311	24.39
TURF/SOD	0.207	16.19
STRAWBERRY	0.184	14.44
POTATO	0.121	9.46
UNCULTIVATED AG	0.083	6.54
GRAPE	0.073	5.70
STRUCTURAL PEST CONTROL	0.059	4.65
WATERMELON	0.043	3.37
LANDSCAPE MAINTENANCE	0.023	1.84
CELERY	0.019	1.49

* Treatment of an area prior to determining which crop will be planted.

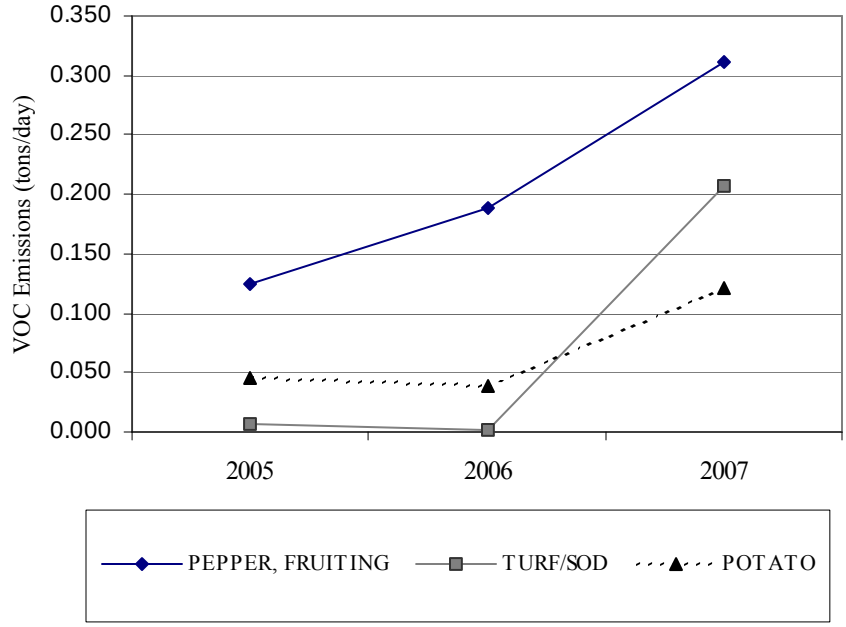


Figure 12. Changes in unadjusted emissions from selected commodities/sites in the Southeast Desert NAA from 2005 to 2007.

Table 15. *Unadjusted* **2007** May–October VOC emissions in NAA 3 by ARB emission inventory classification (tons per day, tpd).

NAA 3 - 2007	**Agricultural Applications**	**Structural Applications**
METHYL BROMIDE EMISSIONS	0.286	0.000
NON-METHYL BROMIDE EMISSIONS	0.897	0.061

Ventura - NAA 4

Ozone season adjusted emissions in the Ventura nonattainment area (NAA4) decreased from 3.924 tpd in 2004 to 3.616 tpd in 2005, increased to 3.682 tpd in 2006 and decreased again to 3.361 tpd in 2007. Emissions did not meet the SIP goal for 2012 (3.029 tpd), but did meet the SIP goal for 2009 (4.029 tpd) and the VOC regulation benchmark for 2009 (3.63 tpd) (Tables 6a, 6b, Figure 3, 13).

As in previous years, fumigants dominate the pesticide inventory for this NAA, accounting for upward of 85 percent of the emissions. The adjusted emissions for NAA 4 in 2004 differ significantly from those estimated by Barry, et al. (2007), due to a revision of the MUFs. For 2004 in NAA 4, the adjusted emissions changed from 4.826 tpd to 3.924 tpd. The difference is due to information indicating more frequent use of lower emission fumigation methods than previously estimated. The most heavily used fumigants in NAA 4 are chloropicrin and methyl bromide, which together accounted for more than 65 percent of emissions (Tables 16, A3-4a, A3-4b, A3-4c, Figure 14). In 2006 and 2007 almost 100 percent of chloropicrin emissions came from applications to

strawberries or "soil fumigation/preplant". Emissions from methyl bromide applications to strawberries decreased from 2005 to 2007, while methyl bromide emissions from "soil fumigation/preplant" applications increased. It should be noted that the commodity/site description "soil fumigation/preplant" refers to applications that are made before the grower has made a decision about which commodity to plant. These sites may be re-identified at a later time as any number of commodities including strawberries, peppers, raspberries, herbs, etc., but it is beyond the scope of this inventory to be able to identify which commodities these are. Other major commodities/sites include tomatoes, raspberries and lemons (Tables 17, A2-4d, A2-4e, A2-4f, Figure 15).

Using the ARB emission inventory classification, emissions from structural applications of methyl bromide remained steady at less than 0.001 tpd since 2005, but agricultural applications decreased from 2.556 tpd in 2005 to 2.537 tpd in 2006 and further to 1.946 tpd in 2007. These findings are consistent with the trend found for the use of methyl bromide to strawberries and soil fumigation/preplant. Non-methyl bromide emissions from agricultural applications have increased from 5.400 tpd in 2005 to 6.049 tpd in 2007, as reflected by the increased use of chloropicrin. Structural non-methyl bromide emissions were less than 0.04tpd (Tables 18, A2-4g, A2-4h, A2-4i).

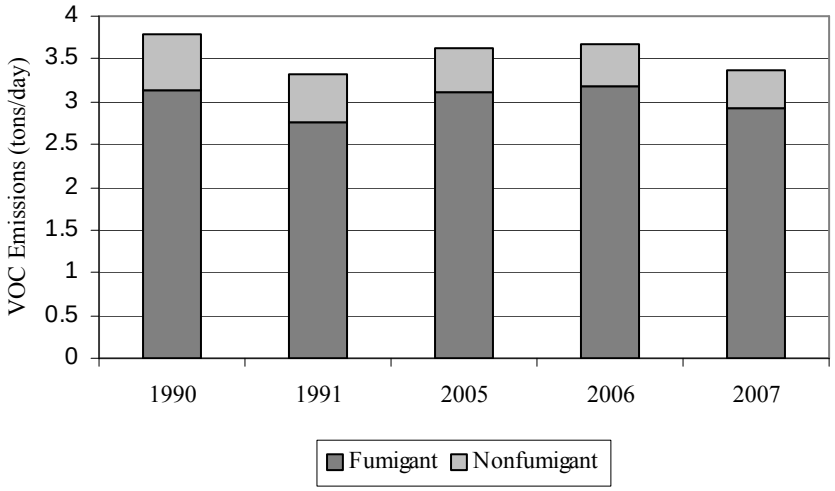


Figure 13. Pesticide VOC emissions for the Ventura NAA, May–October. Emissions for each year are divided into fumigants and nonfumigants. Fumigant emissions are *adjusted* to account for fumigation method.

Table 16. Top ten primary active ingredients contributing to **2007** May-October ozone season *adjusted* VOC emissions in NAA 4, Ventura.

Primary AI	**Total Product Adjusted Emissions (tons/day)**	**Percent of All NAA 4 May – Oct 2007 Adjusted Emissions**
CHLOROPICRIN	1.252	37.26
METHYL BROMIDE	0.934	27.80
1,3-DICHLOROPROPENE	0.674	20.04
METAM-SODIUM	0.071	2.12
CHLORPYRIFOS	0.045	1.33

MINERAL OIL	0.035	1.06
PETROLEUM OIL, UNCLASSIFIED	0.032	0.96
CLARIFIED HYDROPHOBIC EXTRACT OF NEEM OIL	0.032	0.94
ABAMECTIN	0.025	0.74
OXAMYL	0.024	0.70

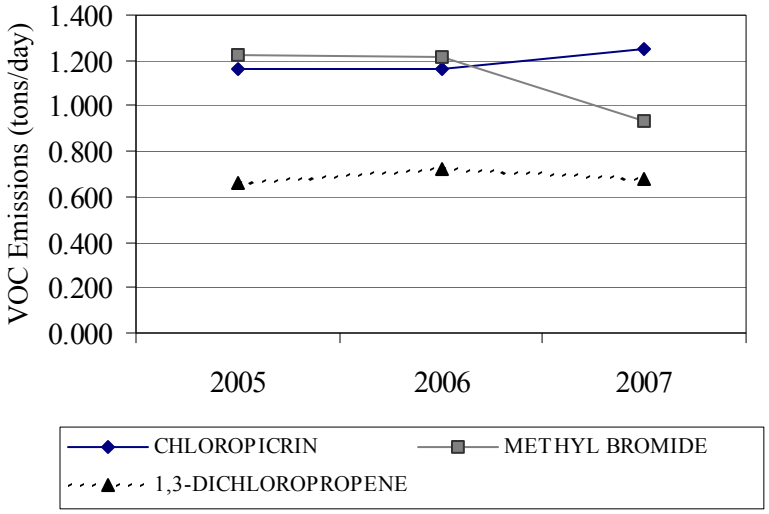


Figure 14. Changes in adjusted emissions of selected AIs in the Ventura NAA from 2005 to 2007.

Table 17. Top ten pesticide application sites contributing to **2007** May-October ozone season *unadjusted* VOC emissions in NAA 4.

Application Site	**Emissions (tons/day)**	**Percent of all NAA 4 May – Oct 2007 emissions**
STRAWBERRY	5.117	56.34
SOIL FUMIGATION/PREPLANT	3.459	38.09
LEMON	0.152	1.67
TOMATO	0.098	1.08
RASPBERRY	0.052	0.57
STRUCTURAL PEST CONTROL	0.038	0.42
PEPPER, FRUITING	0.024	0.26
CELERY	0.018	0.20
TURF/SOD	0.018	0.19
AVOCADO	0.017	0.18

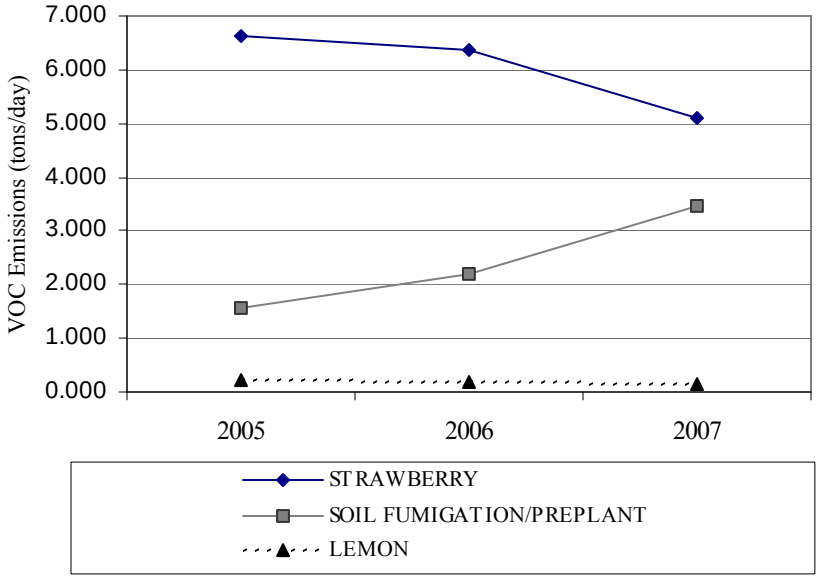


Figure 15. Changes in unadjusted emissions from selected commodities/sites in the Ventura NAA from 2005 to 2007.

Table 18. *Unadjusted* **2007** May–October VOC emissions in NAA 4 by ARB emission inventory classification (tons per day, tpd).

NAA 4 - 2007	**Agricultural Applications**	**Structural Applications**
METHYL BROMIDE EMISSIONS	1.946	0.000
NON-METHYL BROMIDE EMISSIONS	6.049	0.038

South Coast - NAA 5

In the South Coast NAA, adjusted emissions have declined steadily since 2004. Adjusted emissions were 1.922 tpd in 2004, and although they increased slightly to 1.984 tpd in 2005, they declined to 1.495 tpd in 2007, well below the SIP goal of 8.672 tpd and the VOC regulation benchmark of 4.1 tpd. Emissions from nonfumigants accounted for at least 70 percent of the total for the South Coast nonattainment area (Tables 6a, 6b, Figure 3, 16).

The fumigants methyl bromide, chloropicrin and 1,3-dichloropropene, contributed to 28.96 percent of 2005 adjusted emissions, 27.46 percent of 2006 adjusted emissions and 26.04 percent of 2007 adjusted emissions. Permethrin, an insecticide used in structural pest control, landscape maintenance and on a wide range of nursery commodities, was the largest single contributor to the adjusted inventory accounting for 18.4 percent (0.275 tpd) of the emissions in 2007, down from 0.445 tpd in 2005. Methyl bromide emissions have also declined from 0.348 tpd in 2005 to 0.235 tpd in 2007, accounting for fifteen percent of total emissions (Tables 19, A3-5a, A3-5b, A3-5c, Figure 17). Limonene, an oil extracted from citrus that is used almost exclusively in structural pest control, has shown

an increase in emissions in 2007 (0.121 tpd). In 2007 more than three quarters of emissions in NAA5 came from fumigant and nonfumigant use in structural pest control (0.786 tpd) and strawberries (0.752 tpd), with landscape maintenance accounting for less than 10 percent (0.161 tpd) (Tables 20, A2-5d, A2-5e, A2-5f, Figure 18).

Using the ARB emission inventory classification, emissions from structural applications of methyl bromide declined slightly from 0.003 tpd in 2005 and 2006 to 0.002 tpd in 2007. Agricultural applications decreased from 0.508 tpd in 2005 to 360 tpd in 2006 and further to 0.344 tpd in 2007. Non-methyl bromide emissions from agricultural applications decreased from 0.963 tpd in 2005 to 0.698 tpd in 2006, but increased to 0.707 tpd in 2007. Structural non-methyl bromide emissions were declined from 1.041 tpd in 2005 to 0.788 tpd in 2007 (Tables 21, A2-5g, A2-5h, A2-5i).

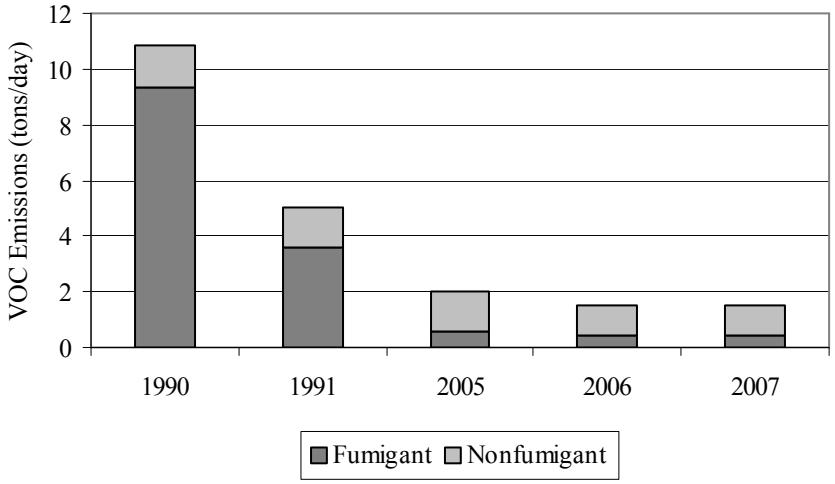


Figure 16. Pesticide VOC emissions for the South Coast NAA, May–October. Emissions for each year are divided into fumigants and nonfumigants. Fumigant emissions are *adjusted* to account for fumigation method.

Table 19. Top ten primary active ingredients contributing to **2007** May-October ozone season *adjusted* VOC emissions in NAA 5, South Coast.

Primary AI	**Total Product Adjusted Emissions (tons/day)**	**Percent of All NAA 5 May – Oct 2007 Adjusted Emissions**
PERMETHRIN	0.275	18.40
METHYL BROMIDE	0.235	15.72
LIMONENE	0.121	8.11
CHLOROPICRIN	0.107	7.13
BIFENTHRIN	0.077	5.14
N-OCTYL BICYCLOHEPTENE DICARBOXIMIDE	0.069	4.59
1,3-DICHLOROPROPENE	0.048	3.19
CYFLUTHRIN	0.042	2.81
CYPERMETHRIN	0.042	2.80
DISODIUM OCTABORATE TETRAHYDRATE	0.042	2.78

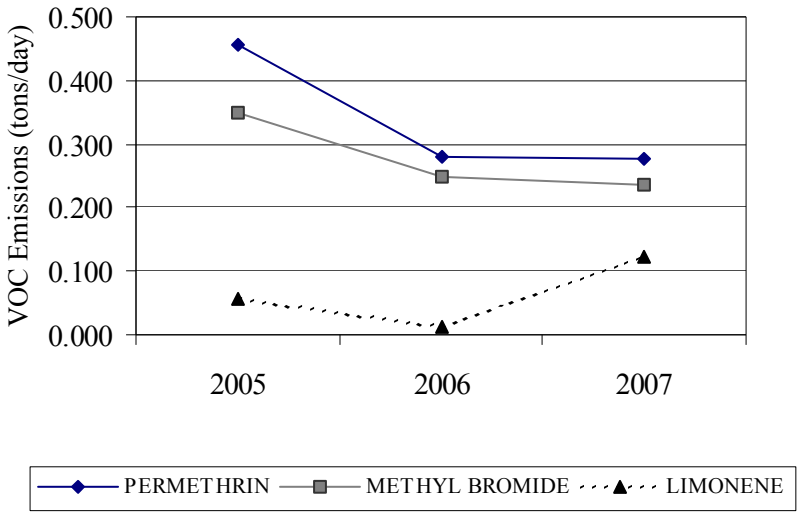


Figure 17. Changes in adjusted emissions of selected AIs in the South Coast NAA from 2005 to 2007.

Table 20. Top ten pesticide application sites contributing to **2007** May-October ozone season *unadjusted* VOC emissions in NAA 5.

Application Site	**Emissions (tons/day)**	**Percent of all NAA 5 May – Oct 2007 emissions**
STRUCTURAL PEST CONTROL	0.786	39.94
STRAWBERRY	0.752	38.21
LANDSCAPE MAINTENANCE	0.161	8.18
FUMIGATION, OTHER	0.058	2.94
N-OUTDR PLANTS IN CONTAINERS	0.043	2.17
RIGHTS OF WAY	0.036	1.83
SOIL FUMIGATION/PREPLANT	0.033	1.68
COMMODITY FUMIGATION	0.027	1.38
AVOCADO	0.009	0.44
GRAPEFRUIT	0.008	0.40

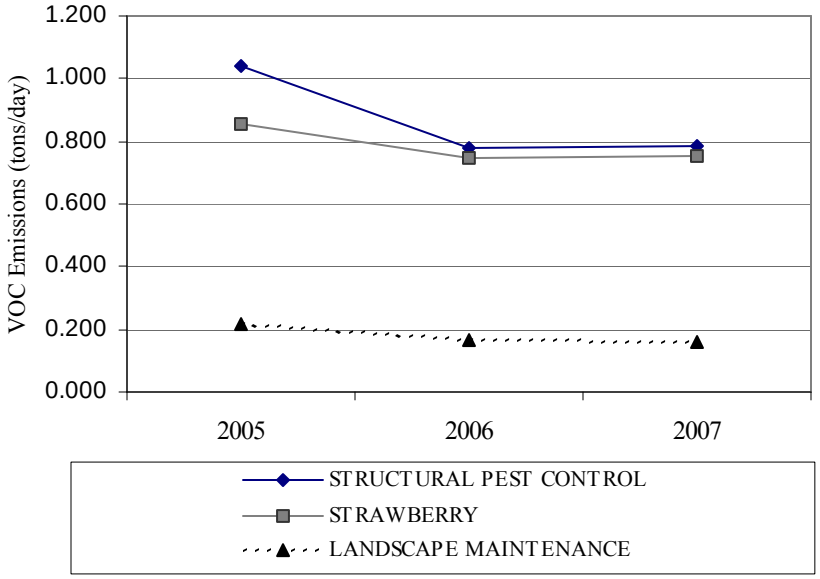


Figure 18. Changes in unadjusted emissions from selected commodities/sites in the South Coast NAA from 2005 to 2007.

Table 21. *Unadjusted* **2007** May–October VOC emissions in NAA 5 by ARB emission inventory classification (tons per day, tpd).

NAA 5 - 2007	**Agricultural Applications**	**Structural Applications**
METHYL BROMIDE EMISSIONS	0.344	0.002
NON-METHYL BROMIDE EMISSIONS	0.707	0.788

PROJECTION FOR 2009 VOC EMISSIONS IN THE SAN JOAQUIN VALLEY, SOUTHEAST DESERT AND VENTURA NONATTAINMENT AREAS.

In 2006, the U.S. District Court (Eastern District of California) ordered DPR to implement regulations to achieve a 20 percent reduction in pesticide VOC emissions relative to 1991 as the base year. DPR complied with the court order by adopting regulations in January 2008 to reduce VOC emissions from fumigant pesticides. Regulations require DPR to establish a fumigant limit for NAAs that exceed 80 percent of the pesticide VOC benchmark. (NOTE: Benchmark is 20 percent reduction or 80 percent of 1991 emissions and a phase-in of reductions for Ventura. Trigger for fumigant limit is 64 percent [80 percent of 80 percent] of 1991 emissions). The regulations also require DPR to determine the fumigant limit for the upcoming year by subtracting the estimated nonfumigant emissions from the regulatory benchmark.

VOC emissions in the Sacramento Metro and South Coast NAAs are well below their regulatory benchmarks, so 2009 fumigant limits are calculated only for San Joaquin Valley, Southeast Desert and Ventura NAAs. In recent years, nonfumigant emissions

accounted for approximately 65%, 30% and 14% of total adjusted ozone season emissions in NAAs 2, 3 and 4, respectively (Table 22).

Table 22. May–October (ozone season) non-fumigant pesticide VOC emissions.

NAA	2004 Emissions (tons/day)	2005 Emissions (tons/day)	2006 Emissions (tons/day)	2007 Emissions (tons/day)	Mean Emissions (%)
2 - San Joaquin Valley					
Non-Fumigants	10.965 (63%)	13.918 (67%)	14.611 (68%)	11.134 (64%)	65%
3 - Southeast Desert					
Non-Fumigants	0.233 (23%)	0.267 (36%)	0.222 (35%)	0.189 (25%)	30%
4 – Ventura					
Non-Fumigants	0.622 (16%)	0.497 (14%)	0.508 (14%)	0.428 (13%)	14%

In general, nonfumigant emissions in these nonattainment areas are variable, as illustrated in Figures 7, 10 and 13. This variability is a result of changes in pest pressure, weather, economic conditions and other unknown factors that occur year to year. In a memorandum entitled "Proposed Method For Estimating Future Nonfumigant Emissions From Historical Data" (Spurlock, 2008), three statistical methods were used to determine the best estimate of nonfumigant use in 2009 based on historical data. While the strongest autocorrelation in San Joaquin NAA was found to be for a lag period of one year (i.e. the similarity in nonfumigant emissions between years is greatest between adjacent years), the most recent nonfumigant data available to forecast nonfumigant emissions for an upcoming year will be at least two years old. This is because of the time lag required to error-check and finalize the annual pesticide use report data that is used to calculate emissions is usually one year. Therefore pesticide use data for 2007 will be the most recent data available for making estimates for 2009.

Of the three methods described by Spurlock (2008), the estimate based on the most recent available year has the highest correlation with actual emissions in two of the three NAAs based on historical data. Results indicate that the best overall method of those evaluated is to estimate nonfumigant emissions as equal to those of the single most recent available year (two years prior to the year being estimated).

In 2007, fumigant emissions in the San Joaquin Valley nonattainment area were calculated to be 6.146 tpd (Table 23), more than the projected fumigant limit based on the VOC regulation benchmark of 4.866 tpd. In the Southeast Desert NAA, a reduction in fumigant emissions of 0.144 tpd or more from 2007 levels would meet the projected fumigant limit for 2009 based on the VOC regulation benchmark. Overall emissions have declined for NAA 4 (Ventura) between 2004 and 2007. The total adjusted fumigant emissions for 2007 were 2.933 tpd, which is below the projected fumigant limit for 2009.

Table 23. Preliminary projection for 2009 VOC emissions for NAAs 2, 3 and 4. The 2009 projected fumigant limits are determined by subtracting the 2007 nonfumigant emissions from the SIP goals and VOC regulation benchmarks.

Non-Attainment Area	SIP Goal (tons/day)	VOC Regulation Benchmark (tons/day)	2007 Nonfumigant Emissions (tons/day)	2009 Projected Fumigant Limit, Based on SIP Goal (tons/day)	2009 Projected Fumigant Limit, Based on Regulation Benchmark (tons/day)	2007 Adjusted Fumigant Emissions (tons/day)
2 - San Joaquin Valley	18.139	16.0	11.134	7.005	4.866	6.146
3 - Southeast Desert	0.923	0.62	0.189	0.734	0.431	0.575
4 - Ventura	4.030 a	3.63 a	0.428	3.602	3.202	2.933

a The Ventura SIP Goal and VOC Regulation Benchmark for 2009 are shown.

REFERENCES

Barry, T., F. Spurlock and R. Segawa. September 29, 2007, memorandum to J. Sanders: Pesticide Volatile Organic Compound Emission Adjustments For Field Conditions And Estimated Volatile Organic Compound Reductions–Revised Estimates. *On-line: http://www.cdpr.ca.gov/docs/emon/pubs/ehapreps/analysis_memos/1955_sanders.pdf*

Federal Register. 1997. January 8, 1997, page 1170, Emission Reductions.

Federal Register. 2008. July 18, 2008, page 41277, Revisions to the California State Implementation Plan; Pesticide Element; Ventura County.

McConnell, L. L., Zeinali, M., Hapeman, C. J. and Schmidt, W. June 12, 2008. USDA ARS Report to CDPR on the Thermogravimetric and FT-IR Analysis of Sulfur Fungicide Products. USDA-ARS Environmental Management and Byproduct Utilization Laboratory, Beltsville, Maryland. *On-line:* *http://www.cdpr.ca.gov/docs/emon/vocs/vocproj/usda_ars_rpt.pdf*

McKinney, M. August 26, 2008. memorandum to Randy Segawa: Analysis of Anomalously High Emission Potential Values for Certain Spray Oil Products. *On-line:* *http://www.cdpr.ca.gov/docs/emon/pubs/ehapreps/analysis_memos/2079_segawa.pdf*

Spurlock, F. 2008. Draft memorandum to R. Segawa. Proposed Method For Estimating Future Nonfumigant Emissions From Historical Data.

Spurlock, F., 2006. July 18, 2006, memorandum to J. Sanders: 2006 Revisions to Procedures for Estimating Volatile Organic Compound Emissions from Pesticides. *On-line:*
http://www.cdpr.ca.gov/docs/emon/vocs/vocproj/voc_calc_revision071805.pdf

Spurlock, F. January 7, 2002 memorandum to J. Sanders. Methodology for determining VOC emission potential of pesticide products. *On-line:*
http://www.cdpr.ca.gov/docs/emon/vocs/vocproj/intro.pdf

Wamerdam, M., August 14, 2008. In the Matter of Grimmway Farms Request for Approval of Reduced Volatile Organic Compound Emissions Field Fumigation Methods. Department of Pesticide Regulation. *On-line:*
http://www.cdpr.ca.gov/docs/emon/vocs/vocproj/decision081308.pdf

Wamerdam, M., February 29, 2008. In the Matter of the Responsible Farmers Coalition's Request for Approval of Reduced Volatile Organic Compound Emissions Field Fumigation Methods. Department of Pesticide Regulation. *On-line:*
http://www.cdpr.ca.gov/docs/emon/vocs/vocproj/decision_review.pdf